AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A fiberoptic sensor for measuring at least one electric current or magnetic field, having

a light source ~~(1)~~,

N sensor heads ~~(H_1,H_2,H_3)~~ that can be arranged in the shape of a coil around current conductors ~~(C_1,C_2,C_3)~~ or along the magnetic field, N being a whole number with $N \geq 2$,

at least one phase modulation unit ~~(PME; PME_1,PME_2,PME_3)~~, having at least one phase modulator ~~(PM; PM_1,PM_2,PM_3)~~,

at least one detector ~~(2;2_1,2_2,2_3)~~, and

a control and evaluation unit ~~(5)~~ that is connected via at least one detector signal line ~~(D;D_1,D_2,D_3)~~ to the at least one detector ~~(2;2_1,2_2,2_3)~~, and via at least one modulator signal line ~~(M; M_1,M_2,M_3)~~ to the at least one phase modulator ~~(PM; PM_1,PM_2,PM_3)~~,

first means ~~(6)~~ being provided for guiding light from the light source ~~(1)~~ into an end ~~(3;3_1,3_2,3_3)~~, on the detector side, of the phase modulation unit ~~(PME; PME_1,PME_2,PME_3)~~,

second means ~~(7)~~ being available for guiding light from the end ~~(3;3_1,3_2,3_3)~~, on the detector side, of the phase modulation unit ~~(PME;PME_1,PME_2,PME_3)~~ to the detector ~~(2;2_1,2_2,2_3)~~,

the at least one phase modulation unit ~~(PME; PME_1,PME_2,PME_3)~~ having a further end ~~(4;4_1,4_2,4_3)~~, on the sensor head side, that is optically connected to at least one of the sensor heads ~~(H_1,H_2,H_3)~~, and

wherein by means of the at least one phase modulation unit ~~(PME;PME$_1$,PME$_2$,PME$_3$)~~ linearly polarized lightwaves can be phase-modulated differentially in a non-reciprocal fashion, ~~characterized in that~~ wherein N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n are provided for the non-reciprocal differential phase modulations, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that it holds for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$p \bullet \nu_n \neq z \bullet \nu_m \text{ and}$$

$$q \bullet \nu_n \neq z \bullet \nu_m,$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.

2. (Currently Amended) The sensor as claimed in claim 1, ~~characterized in that~~ wherein exactly one control and evaluation unit ~~(5)~~ is provided, in which signals that originate from the various sensor heads ~~(H$_1$,H$_2$,H$_3$)~~ and are fed to the control and evaluation unit ~~(5)~~ via the at least one detector signal line ~~(D;D$_1$,D$_2$,D$_3$)~~ can be distinguished from one another by means of frequency filtering, it being possible to convert these signals into N output signals S_n, in particular it being possible to determine the output signals S_n for each n with $1 \leq n \leq N$ from signals at the frequencies $p \bullet \nu_n$ and $q \bullet \nu_n$ in the control and evaluation unit ~~(5)~~.

3. (Currently Amended) The sensor as claimed in ~~one of claims 1 or 2~~ claim 1, ~~characterized in that~~ wherein exactly one phase modulation unit ~~(PME)~~ is provided, and in that N reflection interferometers are provided, each of the N reflection interferometers

including exactly one of the N sensor heads ~~(H_1,H_2,H_3)~~, and the N sensor heads ~~(H_1,H_2,H_3)~~ in each case having a mirrored end ~~(13_1,13_2,13_3)~~.

4. (Currently Amended) The sensor as claimed in claim 3, ~~characterized in that~~ wherein the light source ~~(1)~~ is connected to the control and evaluation unit ~~(5)~~ via a light control signal line ~~(L)~~, and in that a time division multiplexing method is provided for the measurement.

5. (Currently Amended) The sensor as claimed in ~~one of claims 3 or 4~~ claim 3, ~~characterized in that~~ wherein the phase modulation unit ~~(PME)~~ either

(a) is a modulator circuit ~~(PME)~~ having N phase modulators ~~(PM_1,PM_2,PM_3)~~, in particular piezoelectric phase modulators ~~(PM; PM_1,PM_2,PM_3)~~, each of the N phase modulators ~~(PM_1,PM_2,PM_3)~~ being assigned to exactly one of the N modulation frequencies ν_n, and ~~in that~~ wherein each of the N phase modulators ~~(PM_1,PM_2,PM_3)~~ can be operated at the modulation frequency ν_n assigned to it, and ~~in that~~ wherein the differential phase of oppositely directed lightwaves polarized parallel to one another can be modulated, or

(b) includes a single phase modulator ~~(PM)~~, ~~in particular~~ configured as an integrated optical phase modulator ~~(PM)~~, which permits a simultaneous phase modulation with the N various modulation frequencies ν_n, and it being possible to modulate the differential phase of lightwaves that propagate in the same direction and are mutually orthogonally polarized.

6. (Currently Amended) The sensor as claimed in ~~one of claims 1 or 2~~ claim 1, ~~characterized in that~~ wherein N phase modulation units ~~(PME_1,PME_2,PME_3)~~ having one phase modulator ~~(PM_1,PM_2,PM_3)~~ each are provided, the nth phase modulation unit ~~(PME_n)~~ being optically connected to the nth sensor head ~~(H_n)~~, and it being possible to operate the nth phase modulator ~~(PM_n)~~ with the modulation frequency ν_n, and each of the phase

modulators ~~(PM_1, PM_2, PM_3)~~ being connected to the control and evaluation unit ~~(5)~~ via one modulator signal line ~~(M_1, M_2, M_3)~~ each.

7. (Currently Amended) The sensor as claimed in claim 6, ~~characterized in that~~ wherein N reflection interferometers are provided, each of the N reflection interferometers comprising exactly one of the N sensor heads ~~(H_1, H_2, H_3)~~, and the N sensor heads ~~(H_1, H_2, H_3)~~ in each case having a mirrored end ~~$(13_1, 13_2, 13_3)$~~, and
~~in that~~ wherein either
(a) the phase modulation units ~~(PME_1, PME_2, PME_3)~~ are modulator circuits ~~(PME_1, PME_2, PME_3)~~, and ~~in that~~ wherein it is possible to modulate the differential phase of oppositely directed lightwaves polarized parallel to one another by means of the phase modulators ~~(PM_1, PM_2, PM_3)~~, and ~~in particular in that~~ wherein the phase modulators ~~(PM_1, PM_2, PM_3)~~ are piezoelectric phase modulators ~~(PM_1, PM_2, PM_3)~~, or
(b) each of the phase modulators ~~(PM_1, PM_2, PM_3)~~ can modulate the differential phase of mutually orthogonally polarized lightwaves propagating in the same direction and, ~~in particular, in that~~ wherein the phase modulators ~~(PM_1, PM_2, PM_3)~~ are integrated optical phase modulators ~~(PM_1, PM_2, PM_3)~~.

8. (Currently Amended) The sensor as claimed in claim 6, ~~characterized in that~~ wherein N Sagnac interferometers are provided, each of the N Sagnac interferometers including exactly one of the N sensor heads ~~(H_1, H_2, H_3)~~, and
~~in that~~ wherein each of the phase modulation units ~~(PME_1, PME_2, PME_3)~~ is essentially one phase modulator ~~(PM_1, PM_2, PM_3)~~ each, it being possible to modulate the differential phase of oppositely directed lightwaves, polarized parallel to one another, by means of the phase modulators ~~(PM_1, PM_2, PM_3)~~, and
~~in particular, in that~~ wherein the phase modulators ~~(PM_1, PM_2, PM_3)~~ are piezoelectric phase modulators ~~(PM_1, PM_2, PM_3)~~ or integrated optical modulators ~~(PM_1, PM_2, PM_3)~~.

9. (Currently Amended) The sensor as claimed in ~~one of the preceding claims~~ claim 1, ~~characterized in that~~ wherein selection p = 1 and q = 2 is made, and in that the N modulation amplitudes $\phi_{0,n}$ and the N modulation frequencies ν_n are selected in such a way that amplitudes $\alpha_{0,n}$ of the modulation of the differential phase of the linearly polarized lightwaves lie between 1.7 and 2.0, in particular between 1.8 and 1.88, or are essentially 1.84 for all n with $1 \leq n \leq N$.

10. (Currently Amended) The sensor as claimed in ~~one of the preceding claims~~ claim 1, ~~characterized in that~~ wherein either

(a) exactly one detector ~~(2)~~ is provided, or

(b) N detectors ~~(2_1,2_2,2_3)~~ are provided, each of the detectors ~~(2_1,2_2,2_3)~~ being connected to the control and evaluation unit ~~(5)~~ via one detector signal line ~~(D;D_1,D_2,D_3)~~ each.

11. (Currently Amended) The sensor as claimed in ~~one of the preceding claims~~ claim 1, ~~characterized in that~~ wherein N = 3 or N = 6, and the electric currents of three phases of an electric high voltage system can be measured by means of one sensor head ~~(H_1;H_2;H_3)~~ each in the case of N = 3, or being able to be measured by means of two sensor heads ~~(H_n)~~ each in the case of N = 6.

12. (Currently Amended) A method for measuring at least one electric current or at least one magnetic field, a light source ~~(1)~~ emitting lightwaves that are converted into linearly polarized lightwaves, and

the linearly polarized lightwaves being guided into N sensor heads ~~(H_1,H_2,H_3)~~ in which the lightwaves undergo a phase shift, which phase shift depends on the current or magnetic field to be measured, N being a whole number with $N \geq 2$, and

the lightwaves being detected in at least one detector ~~$(2;2_1,2_2,2_3)$~~, and

the lightwaves undergoing a non-reciprocal differential phase modulation in at least one phase modulation unit ~~$(PME; PME_1,PME_2,PME_3)$~~ having at least one phase modulator ~~$(PM;PM_1,PM_2,PM_3)$~~, the at least one phase modulation unit ~~$(PME; PME_1,PME_2,PME_3)$~~ being traversed by the lightwaves both during their propagation from the light source ~~(1)~~ to the sensor heads ~~(H_1,H_2,H_3)~~ and during their propagation from the sensor heads ~~(H_1,H_2,H_3)~~ to the at least one detector ~~$(2;2_1,2_2,2_3)$~~, and

a control and evaluation unit ~~(5)~~ being used both to control the at least one phase modulator ~~$(PM; PM_1,PM_2,PM_3)$~~ and to evaluate signals originating from the at least one detector ~~$(2;2_1,2_2,2_3)$~~,

~~characterized in that~~ wherein

the lightwaves are differentially phase-modulated in a non-reciprocal fashion with N modulation amplitudes $\phi_{0,n}$ and N modulation frequencies ν_n, the modulation frequencies ν_n and two prescribable positive whole numbers p, q with $p \neq q$ being selected in such a way that it holds for all positive whole numbers z and for all whole numbers n, m with $n \neq m$ and $1 \leq n,m \leq N$ that:

$$p \bullet \nu_n \neq z \bullet \nu_m \text{ and}$$

$$q \bullet \nu_n \neq z \bullet \nu_m,$$

and the modulation amplitudes $\phi_{0,n}$ and the modulation frequencies ν_n being selected as a function of modulation-relevant optical path lengths ℓ_n.